

Construction Delivery Approaches

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This paper provides an overview of construction management and its use in conjunction with various project delivery methods.

A project delivery method is a system designed to achieve the satisfactory completion of a construction project from conception to occupancy. The construction process is a complex undertaking that involves many different activities and people in its planning and execution. These tasks, and the roles and responsibilities of the owner, designer, CM, contractor(s), subcontractor(s), vendors and suppliers can be organized in numerous ways to deliver a construction project from concept to completion. The choice of construction delivery method can also have major impact on the success of a project.

Until fairly recently, traditional construction delivery systems have been implemented in a linear sequential order. The design/bid/build approach is organized such that design must be complete before pricing and construction can begin. In this scenario, the owner, architect and contractor are brought together through a competitive, low-bid process that sets up inherently adversarial roles, which can often produce conflict and unsatisfactory results for the owner. Although this system is well understood and has been legally embraced by most state and federal procurement organizations, projects using this delivery approach have experienced various levels of success and in many cases resulted in increasingly litigious conflict. Additionally, today's projects often face increasingly complex issues such as resource and cost volatility, time-challenged document quality, progressively accelerated schedules, tighter budgets, complex funding scenarios, and progressive technology, translating into even more risk in an already risky business.

In recent decades, alternative project delivery methods have been developed to reduce conflict and provide a more logical approach to designing and constructing projects with higher probabilities of success by providing earlier control of scope, budget, schedule and risk. Many public and private owners are recognizing that understanding how cost, schedule, local trade contractor interest and the availability of local manpower and material may impact critical delivery dates *early in the design process*, which gives them a better ability to manage these issues rather than being left at the mercy of the market on bid day. Continued client advocacy throughout the design and construction process can help provide a better working platform from which the inevitable challenges may be resolved more efficiently.

Use of traditional Design/Bid/Build, Construction Management (either Agency or At-Risk), or Design Build all have their own merits and challenges. Since the Corps of Engineers is very familiar with traditional Design/Bid/Build, the remainder of this white paper will address the pros and cons of Agency Construction Management (ACM), Construction Management at Risk (CMAR) and Design-Build (DB).

Construction Management

Construction management is a professional services discipline applied to the planning, design and construction process. CMs provide a program of management techniques and expertise tailored to the owner and project needs required by the chosen contract form or project delivery method. CMs apply and integrate comprehensive project controls from very early in the design process to assist the owner manage the critical issues of risk, time, cost, scope and quality. It is the matching of services to the project and owner needs that makes construction management a cost effective approach to managing project delivery.

Agency Construction Management Services

Agency construction management (ACM), or construction management-for-fee, encompasses a range of services provided by a CM on behalf of an owner. It is a common misconception that CM-for-fee represents a distinct project delivery system. In fact, agency construction management consists of a distinct set of services that are applicable to any project delivery system. These services can be used by the owner as necessary to extend or supplement the owner's own expertise, its own staff, and to manage the design and construction process to help address some of the shortfalls of the project delivery system chosen.

A CM working as an agent to the owner primarily provides the benefit of independent, professional services provided on the owner's behalf throughout the project. In contrast to some other project participants, the ACM has no vested financial interest in the project — in either its design or construction — and maintains a responsibility to act on the owner's behalf to provide impartial advice concerning the construction project. As such, ACM firms should be selected based on qualifications, and not on a cost or low-bid basis.

Services offered by an ACM include the following:

Pre-Design and Design: As discussed earlier, there are often advantages to obtaining construction expertise during the early planning stages of a project. Some services typically offered by ACM firms during planning stages include the following:

- **Selection of a design team:** An ACM firm, based on historical experience in the market, can assist the owner in selecting the most qualified A/E team to develop project plans and specifications. Similarly, an ACM firm can also assist the owner in evaluating various potential construction sites.
- **Budget and Cost Estimating:** Preliminary budgets, based on historical data for similar projects, will assist the owner in determining the feasibility of initial scope. Progressive estimates are developed during the design process to check the design progress against the necessary construction budget, and provide a basis of comparison to contractor bids.
- **Constructibility Review:** A review of design plans and specifications for construction conflicts will help the owner verify that the design as presented is clear to the contractor and is economically feasible and physically practical to build.

- **Value Engineering and Analysis:** A multi-disciplined team reviews project features to ensure that the owner's necessary functions are provided in the most cost-effective way, both in terms of initial and life-cycle costs.
- **Contract Bidding:** An ACM firm can assist the owner in pre-selection of contractors and development of the bid package to ensure that the contractor selection process is fair and provides the best value to the owner.

An ACM is often most cost effective during the planning stages of the project, since the ACM firms can provide the careful planning and organization skills that can help prevent costly problems during construction. Properly executed services such as constructibility reviews and preliminary scheduling can result in significant risk reduction and cost savings many times initial cost in terms of limiting change orders, delays, and contractor claims.

Construction Phase: ACM firms provide a variety of services during construction, including the following:

- **Construction Inspection and Quality Assurance:** Virtually all owners desire some type of examination of project performance on a continuous or periodic basis to review progress, ensure compliance with specifications and plans, and to review housekeeping and safety issues.
- **Project Controls:** These services are provided to ensure that the project is efficiently and effectively managed. Engineering processes are systematically performed, which include maintenance of project documentation, conducting progress and other critical meetings, handling submittals and requests for information, documentation of progress, review of pay requests, schedule reviews and schedule updates.
- **Change Order Review:** These services include negotiation of change orders with the contractor, coordination with A/E over design changes, determination of responsibility for changed conditions or coordination conflict, and review of price and schedule changes.
- **Project Closeout:** Review of the project to ensure orderly and timely completion, including development of punchlists; monitoring of implementation, training and warranty periods; resolution of outstanding issues; review and analysis of claims or disputed issues.
- **Claim Support:** In the event of a dispute, a variety of claim support services can be performed by the ACM to support the reasonable and timely resolution of conflict. These include schedule/delay analysis, contract interpretation, and cost analysis.

The most frequently cited criticism of ACM services is that the CM adds a level of bureaucracy to a project, resulting in added cost. While it can be argued that such costs may actually reduce overall project costs, it should be noted that an owner can realize the benefit of the ACM services without necessarily committing to large increases in expense by supplementing its own project management only as necessary and selecting ACM on a service-specific basis. In short, the goal of ACM services is to enable the owner to successfully fulfill its responsibilities under the specific project delivery methods and contract forms chosen.

At-Risk Construction Management

When the CM's scope of work includes construction performance, it is by definition a project delivery method. This delivery method is most commonly known as at-risk construction management because the CM has responsibility or risk for budget and schedule execution. In this scenario, as with the agency role, the at-risk CM provides advisory professional management assistance to the owner prior to construction, offering schedule, value analysis, budget and constructibility advice during the project planning phases. The CM is a strategic member of the team, offering advice to the owner and designer on how to achieve the most building program for the budget available, the strengths and weaknesses of the local contracting community, and providing direction to the design team on the best way to package contract documents to achieve the best schedule results and greatest interest from local subs. Since it will be responsible for executing the plan developed during preconstruction, the CM has a vested interest in becoming an active, contributing member of the team.

For best results, the CM should be selected through a competitive, best value source selection process. Invited firms responding to the terms of an RFP are evaluated on technical qualifications including experience and management approach, as well as competitive pricing on fee and general conditions. . At an appropriate point in time when the design is sufficiently complete, the CM prepares an estimate for construction performance and offers the owner a total project cost, usually in the form of a guaranteed maximum price (GMP) or fixed price (lump sum), that locks in both price and period of performance. In this delivery method, all trade contracts are usually held by the CM and contain the necessary provisions to allow the CM to manage and control the trade contractors to assure performance in terms of time, cost, and quality. The CM is responsible for the means, methods, techniques, and sequence of construction. It is also responsible for scheduling and coordinating the trade contractors. As such, the CM then becomes the sole point of responsibility and accountability to the owner for timely execution of the construction. The CM has the obligation to enforce the schedule, pay the trade contractors, and terminate them if such action becomes necessary.

Trade contracts may involve taking competitive bids or negotiating direct contracts. In this way, competition throughout the procurement process is maintained. Unless prohibited by law, the CM also has the option of performing portions of the work with its own resources. Whichever the format, it is recommended that the CM use an "open-book" approach to procurement. Bid results and bidder selection are available or "open" to the owner, as well as the CM's own fees, general conditions, and contingency.

The guaranteed maximum pricing (GMP) format is commonly used with a CM-at-risk delivery method to facilitate the fast track process (the overlapping of the design and construction activities). Under the GMP concept, a guaranteed maximum price is established before construction starts, based on a certain defined set of construction documents. The GMP includes either the estimated or bid costs of trade contracts necessary to complete the cost of the work; purchases from suppliers and vendors; general condition items; the contractor's fee; reimbursable expenses, and construction contingency. Since many GMP contracts are negotiated before the project is completely designed and specified, a design contingency is often held outside the GMP, to be drawn against as the exact scope of the work becomes better defined. The construction contingency included in the GMP, which is separate from the design contingency, exists as an assurance by which

the CM can provide a guaranteed maximum price, and typically covers scope gaps or unidentified buyout under-estimates at the time the GMP is prepared. Normally, this contingency is managed by the CM and monitored by the owner. Any dollars remaining in the contingency at the end of the project are identified as project savings and disbursed in accordance with the contract provisions. Items that are difficult to estimate or are dependent upon the owner's later decision are sometimes priced as *allowances*, whereby an agreed upon allowance is established to cover the eventual cost. Once in construction, the CM at-risk remains an advocate for the owner by maintaining a complete open-book policy established during trade contractor procurement. The owner is invited to review all costs on the project and is encouraged to participate in subcontractor bid openings and scope review sessions.

The CM's compensation is normally broken into two phases and identified separately for the preconstruction and construction phases. During the preconstruction phase, the CM will usually be compensated on a fixed fee, lump sum, or cost reimbursable basis and paid in monthly portions. Another option is to compensate the CM on a labor times a multiplier for overhead and profit, with a not-to-exceed cost limitation. The preconstruction phase usually ends at the point in time that the CM at-risk submits its GMP. When an agreement on a GMP is reached with the owner, an amendment to the original agreement is written and the CM at-risk is given notice to proceed into construction.

It is important the phrase *guaranteed maximum price* be clearly defined in the contract as to what it includes and specifically excludes. Terminology such as "construction costs" or "project costs" must be clearly defined. The definition of construction costs is usually stated as the cost of all work required to complete the construction as defined in the construction contract documents. Normally, it does not include such items as land costs, professional service costs, or the cost of movable equipment, furniture, etc. In addition, definitions should be provided for reimbursable and non-reimbursable costs.

Since the terminology of a guaranteed *maximum* price implies that the actual price could be lower, it is reasonable for an owner to expect that it might realize a savings by paying the at-risk CM the actual cost of completing the project. The owner can encourage the CM to deliver such savings by offering an incentive to share the savings below the GMP with the CM and by retaining the right to audit the project at its completion. The purpose is to challenge the CM to construct the project for less than the established GMP. The keys for successfully achieving benefits from such a clause include the establishment of a realistic GMP, mutual cooperation on reasonably foreseeable conditions at time of GMP, and a commitment to pursuing open and honest information exchange during construction.

As in most contracts, the owner has the right to make changes. Accordingly, the contract should be clear as to how the GMP will be equitably adjusted for both added and deleted work. If the project is extended beyond the scheduled completion date for reasons beyond the control of the at-risk CM, a time extension and an increase in the CM's compensation may be required.

General Condition Items. Typically, the at-risk CM will be responsible for providing general condition items. General condition items may include site-specific and conditional supplementary costs, such as security, hoisting, cleaning, temporary facilities and construction, protections and other miscellaneous and supporting costs. The cost of general condition items, including related labor costs expended by the CM, is typically paid

when such costs are actually incurred. An alternative is to establish a maximum cost of performance for the general condition items for the project. This can be achieved by a lump sum, cost not to exceed limit, or even a GMP.

Advantages and Challenges

The advantages of using the at-risk CM approach as a project delivery method include:

- Earlier development of effective working relationships for the project team
- Benefit of the constructor's input during the Design Phase while allowing the owner to maintain control of the Design (vs. Design-Build)
- More streamlined design process with a packaging plan that meets local capabilities
- An owner advocate that is instrumental in planning project completion during the design phase and executing the plan during the construction phase
- Earlier cost security for the owner, the guarantee of the construction costs before the contract documents are complete.
- Earlier shifting of risk to the Construction Manager as constructor
- Open book GMP option
- Cost savings/sharing incentives if the final construction cost is less than the GMP
- Less exposure to the owner for the problems of schedule and coordinating the trade contractors
- Schedule fast-tracking: The at-risk CM scenario offers the opportunity to begin construction prior to completion of the design. The CM can bid and subcontract portions of the work at any time, often while design of unrelated portions is still not complete. In this circumstance, the CM and owner negotiate the GMP or fixed price based on a partially completed design, which includes the CM's estimate of the cost for the remaining design features. Furthermore, the CM may allow performance specifications or reduced specifications to be used, since the CM's input can lead to early agreement on preferred materials, equipment types and other project features.

The challenges of the at-risk CM delivery method include:

- If the contract price is established too early on in design,
 - design flexibility may be impacted as the design is driven to be within the constraints of the early GMP; and
 - design and construction contingencies held within the GMP will be higher.
- The owner may have limited control over the use of construction contingency held in the GMP, however, contingency provides flexibility for scope gaps and the ability to expedite construction, should it be required.
- On public projects, the CM who guarantees the cost of a project may not have the right to self-perform portions of the work if all work is required to be bid.

An owner wishing to use the at-risk construction management approach can realize many benefits. Chief among them are the opportunity to incorporate a contractor's

perspective and input to planning and design decisions and the ability to “fast-track” early components of construction prior to full completion of design. However, since a commitment for construction performance is made earlier in the process, a premium is placed on the proper selection of the CM who can provide the best value to the owner.

This delivery approach is best suited for:

- Larger new or renovation projects
- Projects which are schedule sensitive, difficult to define, or subject to change
- Projects on which the owner needs financial cost guarantee

And is less suited for:

- Smaller projects
- Repetitive projects

Design-Build

The design-build (DB) project delivery method has grown in popularity, and is seen by some in the industry as a solution in addressing the limitations of other methods. For the owner, the primary benefit is the simplicity of having one party responsible for both the development of the design and the execution of the construction for the project. A key factor greatly influencing recent interest in DB is the increased desire of owners to have a single point of responsibility for their projects to reduce their risk and the potential for disputes.

Under this method, the owner contracts with a DB team to plan, implement, and control the entire project through completion, occupancy, or startup. However formulated, the DB team performs the complete design of the facility, usually based on a preliminary scope or design presented by the owner. At some point early in the process, the DB team will usually negotiate a fixed price to complete the design and construction of the facility.

While there are many design-build firms which provide all of the essential services required for project delivery, this approach typically involves a joint venture, usually between a constructor and a design consultant, with both firms having some direct or related experience with the type of facility planned by the owner. One variation of the typical DB team structure, known as fee-paid developer, involves the owner engaging a developer, which then selects its own designer and contractor partners. Another variation of this delivery form is when a construction firm takes on the total responsibility and subcontracts for the design services.

Under the design-build delivery method, all design, vendor, supplier, and construction contracts are held by the DB team. During the Construction Phase, the DB firm may do all of the work or subcontract portions of the work required. Subcontracts may be negotiated or competitively bid. Basically, the owner has reduced involvement other than making the key decisions that are necessary throughout the design-build process. The owner may want to supplement its staff with an advisory (agency) CM to provide certain technical support services to assure that the DB team is achieving the goals and objectives established for the project.

Design-Build Advantages. Design-build delivery systems can provide distinct advantages for the owner. This approach:

- Is performance based
- Allows construction expertise to be involved during design phase
- Provides a single point of responsibility with which to communicate
 - Early assignment of risk
 - Reduces owner need for coordination and schedule
 - Reduces exposure to complex, multi-party claims
- Minimizes the obligation of the owner to schedule and coordinate the overall project
- Allows early identification of guaranteed cost
- Allows the owner to begin a project with very little information, proceed through a project feasibility phase (if necessary), and ultimately end up having a DB firm guarantee that certain performance characteristics will be achieved when the project is complete. (Fast Tracking)
- Provides opportunity for incentives/shared savings

Design-Build Challenges. While DB may be advantageous in some ways, it also has some drawbacks for certain owners who wish to retain a) tighter control on design as well as other aspects of the project, and b) the ability to make changes as the project progresses through design and construction. Disadvantages include:

- Less Owner-Control
 - Budget
 - Schedule
 - Technical Input
 - Quality
 - Performance
 - Early Mitigation of Problems
- Fewer Checks and Balances
- Greater Potential for Changes regarding Quality and Performance
- Less Opportunity for Community Participation
- Contractor Profits may be Excessive
- Potentially Adversarial

Design-Build may be best suited in:

- New or renovation projects that are highly schedule driven
- Conventional projects for which project requirements can be clearly defined and for which expertise is widely available. For example, a classroom/office facility or dormitory complex
- Prototypical and repetitive projects
- Certain performance-based infrastructure projects, such as mission-critical facilities, power redundancy projects or utility tunnels
- Highly Specialized Designs

And least suited in projects:

- With scope that is difficult-to-define
- With a high potential for design change
- Where schedule is less sensitive
- In which owners desire strong involvement (e.g., design and quality control)

Owners with highly specialized program needs or desires may not find it advantageous to turn over responsibility to an outside DB team, without ensuring adequate levels of oversight and communication. For example, a government agency constructed a high-technology research facility involving highly specialized equipment using design-build. During project development, the DB team made several key design and equipment selection decisions without full involvement of the owner, resulting in an unsatisfactory facility that required costly changes.

Summary

Construction Managers perform professional tasks throughout all the phases of program or project implementation. The contract agreement establishes the scope of services and defines the relationship of the parties. Regardless of the project delivery method used, a professional CM should improve the owner's confidence in the success of the project. This enhanced confidence grows out of the ability of a professional CM to make expert recommendations regarding:

- Most effective use of available funds
- Enhanced control of the scope of the work
- Optimal project/program scheduling options
- Best use of individual project team members' expertise
- Maximum avoidance of delays, changes and claims
- Enhanced design and construction quality
- Optimum flexibility in contracting/procurement options

Construction management includes a significant component often missing from the project delivery systems - a comprehensive management and control effort applied to the project for the owner, beginning in the early program planning stages and continuing through project completion. It involves the application and integration of comprehensive project controls to the design and construction process and generally includes the following:

- Development of a written scope understood by all of the participants
- Quality assurance throughout the design and construction process
- Consideration of material, systems and process alternatives
- Continued owner advocacy throughout design and construction
- Constructibility review
- Code compliance review
- Milestone cost estimating - to ensure design complies with the budget
- Matching construction spending to funds availability
- Construction specification enforcement
- Continuous schedule enforcement

The implementation of these management activities turns the planning, design and construction process into one that maximizes the owner's control over the project's scope, quality, time, and cost, and adds predictability of the outcome of the project from the start of programming to completion of construction.

Clearly, there is no one right project delivery method for a given project. All of the methods discussed have been used successfully, and have weaknesses which can limit their success. The following considerations should guide the owner in selecting the proper delivery method:

- **Type of Project:** The owner should gauge the level of complexity and uniqueness of the project, and maintain an appropriate level of control. Is the scope difficult to define?
- **Early Builder Input:** Is early builder input such as design, schedule, budget and constructibility required/desirable?
- **Size of Project:** The amount of outside assistance and number of project participants should match the significance of the project. Obviously, the more complex and costly a project, the greater the need for professional management and advice.
- **Owner Capabilities:** The owner should realistically assess its own in-house capabilities in evaluating project procurement methods.
- **Time Considerations:** If the project needs to be constructed in a severely compressed time limit, methods adaptable to fast-track construction should be considered. However, the owner must weigh the need for the compressed time limit against the increased cost and risk of fast tracking.
- **Likelihood of Changes:** If the owner is aware that its requirements may change considerably during the project, this should be evaluated against the potential cost of such changes. For example, a DB team may present the most fluid method of incorporating changes during construction, but those changes may come at a higher cost than through other methods.

Using these criteria for selecting the appropriate approach, an enhanced level of management can be implemented through construction management from early in the design phase through construction and turnover. Regardless of the approach, professional construction management provides an opportunity to supplement the owner's management capabilities in constructing the best facilities possible, on time and within budget. Large, aggressive programs can be accomplished with a greater likelihood of success by assembling a management team focused on owner advocacy throughout design and construction. Benefits such as preconstruction feedback on pricing and alternate materials, builder input on approach and logistics, and better control over schedule and budget may be accomplished through the appropriate construction management delivery approach.